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Report Highlights:

There have been no significant policies or regulatory changes in the Agro biotechnology sector in Singapore in the last twelve months. Two new GMOs have been approved since the last report. Several new members have been appointed to the Genetic Modification Advisory Committee. In the area of capacity building and outreach, Ag Affairs Singapore, as in previous years, helped to recruit participants from Singapore, Brunei and Papua New Guinea to participate in a number of USDA organized APEC conferences and workshops on Agro biotechnology in Singapore and in neighboring countries.

Section I. Executive Summary:

SECTION I. EXECUTIVE SUMMARY

Singapore does not have specific legislation regulating genetically modified organisms.

However, in order to balance domestic safety concerns and to achieve a biosafety framework in line with international standards, Singapore has set up a science based regulatory framework including the formation of the Genetic Modification Advisory Committee (GMAC) to establish biosafety guidelines in Singapore for genetically modified organisms (GMOs). In 2006, GMAC published the Singapore Guidelines covering the release of Agriculture-related GMOs and the Singapore

Biosafety Guidelines for research on Genetically Modified Organisms. Prior to the imports and distribution of genetically modified organisms into the Singapore market, applications have to be submitted to the Genetic Modification Advisory Committee (GMAC) for approval.

Countries in the Asia-Pacific region are starting to realize that needed increases in food production over the next decade will have to come from the application of new technology to increase crop yields and to reduce losses through pests, uncertain elements of weather, handling, storage and distribution. Singapore recognizes this need and hopes to play a key role through the establishment of agro technology parks and the Agro-Bio Park. These agro tech parks are intended to promote R&D in agro technology, and at the same time, attract foreign and local investments in a wide range of agro tech activities with the objective of developing the nation into a regional hub for agricultural consultancy, research on seed technology and agro technology research and development in tropical agriculture.

In addition, research and development in gene therapy, biologics R&D, diagnostics and genetic engineering have long been considered fundamental to Singapore's rapidly expanding biomedical industry, a key pillar of Singapore's economic growth and a major export sector.

While no new and separate legislation has been established specifically for the import, production or distribution of genetically modified organisms, Singapore authorities are relying on existing food regulations under the Food Act to exercise regulatory controls and oversight. Furthermore, the mandatory review process for the imports of new GMOs in the market will provide an additional interlocking measure to ensure food safety.

All imported foods, both GMOs and non-GMOs have to be determined safe by their respective national regulatory bodies of the exporting countries as well as in compliance with international safety standards established by Codex Alimentarius before they are allowed entry into Singapore.

Section II. Plant Biotechnology Trade and Production:

New introductions of any agriculture-related GMOs in Singapore have to be submitted to the GMAC for review in accordance with the guidelines laid down by the Subcommittee on the Release of Agriculture-Related GMOs.

The guidelines cover both processed and unprocessed food products and provide the framework for assessment of risks of agriculture-related GMOs to human health and the environment. These guidelines also provide the approval mechanisms for their release in Singapore. Once the application has been endorsed by GMAC, it will be forwarded to the regulatory authorities for approval.

Singapore currently does not produce any agricultural-related GMOs in Singapore or outside the country. There are also no domestically initiated biotechnology crops under development nor does Post envisage any that will be on the market in the next 12 months.

Singapore has already approved the import of agricultural biotech products such as genetically modified corn and soybeans to be used in foods and feeds. Some of these are U.S. origin. In September, 2007, the Singapore Government completed a six-month trial monitoring of soya grains and corn kernels. Singapore importers were required to indicate the transgenic content of the shipment of corn or soy grains and products on their permit application including the specific transgenic crops or events present in the shipment. Some Singapore importers, U.S. millers and exporters expressed difficulty in identifying any genetically modified grains since they do not segregate the different varieties of corn and soya grains handled and processed through the same equipment.

According to the Singapore Government, the purpose of this trial was to explore a suitable mechanism to track food products of genetically modified origin that are imported into Singapore. The United States was concerned that these requirements may present significant challenges to Singapore importers of U.S. corn and soy grains without providing any safety benefits to Singapore consumers.

Singapore, with one of the highest per capita incomes in the world (about \$24,000 per annum), is not a food aid recipient and is unlikely to be one in the foreseeable future.

Section III. Plant Biotechnology Policy:

Regulatory Framework:

The Genetic Modification Advisory Committee (GMAC) comprising of members from ten government, scientific and educational agencies was established in Singapore in April 1999. The main objective of GMAC is to oversee and advise on the research and development, production, use, handling and release of GMOs in Singapore ensuring that these are done in compliance with international standards.

GMAC has developed the regulatory and administrative framework for approving biosafety guidelines regarding GMOs, as well as for the exchange of information with overseas agencies to facilitate the harmonization of guidelines with regional and international authorities. These guidelines address issues related to food safety based on the concept of substantial equivalence.

The biosafety guidelines that are being developed will be in line with international safety standards and will strive to create a streamlined approval and evaluation process.

Central to this framework is the use of existing legislation and food regulations enacted under the current Food Act to regulate the import and distribution of genetically modified organisms. GMAC's recommendations will be transmitted to the relevant regulatory agencies for adoption and implementation.

The GMAC Committee consists of representatives from national agencies:

- *Agency for Science, Technology and Research(A*STAR)
- *Agri-Food and Veterinary Authority of Singapore (AVA)
- *Ministry of Manpower
- *Consumers Association of Singapore (CASE)
- *Institute of Molecular and Cell Biology (IMB)
- *Ministry of Health (MOH)
- *Nanyang Technological University (NTU)
- *National Institute of Education (NIE)
- *National Parks Board (NParks)
- *National University of Singapore (NUS)

The GMAC Committee has established four subcommittees responsible for the following areas of interests as identified below:

1. Release of Agriculture-Related GMOs
2. Biosafety Guidelines for Research on GMOs.
3. Labeling of GMOs and GMO-derived products.
4. Public Awareness

Importers applying to bring into Singapore genetically modified organisms must first prove that these GMOs are considered safe for public consumption in their countries of origin before they are allowed entry into Singapore. Food producers must perform tests on the quality, allergenicity, toxicity, composition and nutritional values of food derived from GMOs before these foods are allowed entry. Foods containing new substances as a result of genetic modification are subjected to additional tests.

Singapore Biosafety Guidelines for Research on GMOs

The Genetic Modification Advisory Committee (GMAC) released in May 2006 a new set of guidelines to further promote and enhance the biosafety culture amongst Singapore scientists who are working on genetically modified organisms and to establish a common framework for the assessment and notification of research on GMOs in Singapore.

Entitled the 'Singapore Biosafety Guidelines for Research on Genetically Modified Organisms' the Guidelines provide the road map for ensuring public safety while allowing for the commercial exploitation of GMOs and GMO-derived products by companies and research institutions in Singapore. The Singapore Biosafety Guidelines for Research on GMOs was the first

local guideline specific to genetic modification research.

Registration of Approved Agriculture-Related GMOs

A register of approved agriculture-related GMOs was established and is updated by the GMAC Secretariat. Once the GMOs under consideration are approved for release, the GMOs are registered with the GMAC Secretariat.

Procedures for Notification

All agriculture-related GMOs imported into Singapore by the importer/distributor should be in compliance with existing national and international regulations.

Prior to the distribution of any agriculture-related GMOs in Singapore, the importer is required to submit a proposal before GMAC. The importer should consult GMAC to determine the appropriate approval process for the agriculture-related GMOs and the specific information necessary for an assessment.

Filing an application

Proponents can file an application for the approval of agricultural biotech products under the current regulatory framework set up.

Procedures for approval

The GMAC will forward the proposal to the Sub-Committee. The Sub-Committee may either endorse/reject the proposal or appoint the relevant agency or an expert panel to evaluate the proposal within 90 days. The panel of experts will review and assess the risks associated with each stage of the release using the questionnaire and risk assessment criteria as attached as Appendices 1 and 2. The agency/expert panel will submit their recommendations to the Sub-Committee within 90 days.

The GMAC will decide on the recommendations of the Sub-Committee within 60 days.
GMAC can request further information/clarification from the Proponent should the need arises.

Review Process

The proponent is required to disclose the necessary information for risk assessment and safety. The broad classification of information required for GMAC to carry out a risk assessment includes:

1. Species of organisms
2. Eventual use of GMO
3. Location for release
4. Habitat and ecology
5. Genetics of the GMO
6. Data from contained work and other studies
7. Experimental procedures, monitoring and contingency planning

Political Factors

Singapore authorities follow internationally proven science based standards in enacting the regulatory framework for approving the imports of agriculture related GMOs. Singapore tends to follow the lead of developed countries and international bodies like CODEX in allowing the entry of GMOs into the country.

Names of GMAC office holders

Names and agencies of current office holders of the GMAC Committee:

Professor LEE Sing Kong(Chairman)
Director
National Institute of Education

Professor Paul TENG (Deputy Chairman)
Dean
National Institute of Education

Dr. CHUA Sin Bin
Consultant
Agri-Food & Veterinary Authority of Singapore
(Chairman, Subcommittee on Labeling)

Professor Prakash KUMAR
Professor
Department of Biological Sciences
National University of Singapore
(Chairman, Subcommittee on Research on GMOs)

Dr. Paul CHIEW
Director, Laboratories Department
Agri-Food and Veterinary Authority of Singapore
(Chairman, Subcommittee on Public on Public Awareness)

Associate Professor Peter DROGE
Head, Genomics and Genetics Division
School of Biological Sciences, Nanyang Technological University

Mr. SEAH Seng Choon
Executive Director
Consumers Association of Singapore

Dr. Srinivasan RAMACHANDRAN
Associate Director
Strategic Research Programmes
Temasek Life Sciences Laboratory

Dr. FOO Ngee Chih
Deputy Director
Biomedical Research Council
Agency for Science Technology and Research

Ms. Mavis CHIONH
Official Assignee & Public Trustee/Official Receiver
Insolvency & Public Trustee's Office
Ministry of Law

Dr. HO Swee Far
Director
OSH Specialist Department
Ministry of Manpower

Ms. Wendy YAP
Assistant Director, International Relations

Strategic Research Programmes
Biodiversity Centre
National Parks Board

Assistant Prof Uttam SURANA
Principal Investigator
Institute of Molecular and Cell Biology

Dr. LING Ai Ee
Chairman
Singhealth Institutional Biosafety Committee
Singapore Health Services

List of Biotechnology crops permitted to be imported into Singapore

Crop	ID	Purpose
Corn	MON863	Food, feed, or as ethanol
Corn	NK603	Food, feed, or as ethanol
Corn	MON88017	Food, feed
Canola	GT73	Food, feed
Cotton	15985	Food, feed
Cotton	MON1445	Food, feed
Cotton	MON531	Food, feed
Cotton	MON88913	Food, feed
Sugar beet	H7-1	Food, feed
Soy bean	40-3-2	Food, feed
Soy bean	MON 89788	Food, feed
Corn	59122	Food, feed

Following are the new GMOs approved by AVA since the last report.

<i>Crop</i>	<i>ID</i>	<i>Purpose</i>
<i>Maize</i>	<i>1507</i>	<i>Food, feed</i>
<i>Soybean</i>	<i>356043</i>	<i>Food, feed</i>

Policy on Labeling GMOs

Currently Singapore does not have labeling regulations as the authorities recognize that it is a very complex issue that requires careful consideration of several factors, e.g. threshold levels, types of foods to be labeled, and the scientific basis to be used for labeling.

The Singapore government is monitoring and studying worldwide developments on this subject. It will wait and assess

decisions reached at Codex Alimentarius meetings and see if subsequent recommendations that are adopted at these meetings can be embraced in the local context.

Section IV. Plant Biotechnology Marketing Issues:

Marketing Issues

Singapore has not enacted laws to specifically keep out genetically modified foods. Products that are deemed safe for consumption by their national food regulatory bodies in their respective countries of origin will be reviewed by the GMAC committee prior to their release in the Singapore market.

In general there are no barriers to the import of U.S. genetically modified products that have already been approved by U.S. federal agencies like FDA. There are basically no political barriers enacted against the import of genetically modified organisms.

There are also no vocal consumer groups in existence in the country which are against the imports of GMO products.

Public Awareness Campaign

Efforts have routinely been made to educate the public on genetically modified organisms (GMOs) or GMO derived products through public awareness programs.

In a nation wide survey in May 2005 commissioned by GMAC, it was found that only 40 percent of the Singaporeans surveyed have heard of the term 'genetic modification'. However, only half of this group understood the terminology and basic concepts. Among those who have heard the term 'genetic modification' attitudes towards genetically modified foods were favorable. About 20 percent of respondents thought that eating genetically modified foods could change a person's genes.

Since 2001, GMAC through its Subcommittee on Public Awareness has organized public forums, conducted talks, gave interviews to schools, media and civic organizations and distribution of brochures on GMOs and genetically modified foods to the general public.

On Jan 26, 2007, GMAC and the International Service for the Acquisition of Agri-biotech Applications (ISAAA) organized a public forum to address key issues on biotech crops.

The forum was very well attended by the media, business people, students and the general public.

In 2008, GMAC organized the GMAC Student Reporters' Challenge 2008 where school students were invited to participate in a creative writing and design competition. During the GMAC Press Event held in February 2008, student reporters were given the opportunity to ask GM related questions to an expert panel comprising members of GMAC, Consumers Association of Singapore and the Agri-Food & Veterinary Authority of Singapore. The student reporters created newsletters to report the findings achieved at the event.

Cartagena Biosafety Protocol

At the time of writing this report, Singapore is not a signatory to the biosafety protocol.

Section V. Plant Biotechnology Capacity Building and Outreach:

The Office of Agricultural Affairs (OAA) in Singapore helped to recruit delegates to the following Agro biotech workshops in Sapporo in 2010, in Bangkok and in the U.S. in 2011. Participants who attended came from APEC member countries.

1. APEC High Level Policy Dialogue in Agro Biotechnology, May 2010, Sapporo

2. APEC Innovation Technologies Conference, May 2011, Big Sky, Montana
3. APEC Laboratory Capacity Building Workshop August 2011, Bangkok .

Section VI. Animal Biotechnology:

Section VII. Author Defined:

SECTION VI. Reference Materials

Useful websites: Genetic Modification Advisory Committee

Website: <http://www.gmac.gov.sg>

Agri-Food & Veterinary Authority of Singapore

Website: <http://www.ava.gov.sg>

END OF REPORT